PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 108	(1996) Fire Tests of Roof Coverings

FACTORY MUTUAL ENGINEERING AND RESEARCH CORPORATION (FM)

FM P7825	(1999) Approval Guide

SINGLE PLY ROOFING INSTITUTE (SPRI)

ANSI/SPRI	(1997) Wind Design Standard for Single-Ply Roofing Systems

UNDERWRITERS LABORATORIES INC. (UL)

UL RMSD	(1997) Roofing Materials and Systems Directory
UL 790	(1997) Fire Resistance of Roof Covering Materials

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures:"

1.2.1 SD-02, Shop Drawings

a. TPO sheet

Submit membrane manufacturer's drawing indicating locations of perimeter half-sheets, spacing of perimeter and infield fasteners, flashing details, lightning rod application details, and seaming data. The drawing shall reflect the project roof plan of each roof level and conditions indicated.

1.2.2 SD-03, Product Data

a. TPO sheet

b. Adhesive

c. Fasteners

d. Lap cleaner, sealant, and edge treatment

e. Flashing

f. Flashing accessories

g. Roof insulation

Sample warranty certificate;

Submit all data required by Section 07220, "Roof and Deck Insulation," together with requirements of this section. Data shall include written acceptance by the roof membrane manufacturer of the insulation to be provided.

1.2.3 SD-07, Certificates

a. Qualification of manufacturer

b. Qualification of applicator

Certify that the applicator meets requirements specified under paragraph entitled "Qualification of Applicator," and include names and locations of 5 qualified installations and the roofing system manufacturer's written approval of the applicator.

1.2.4 SD-08, Manufacturer's Instructions

a. Cold weather installation

Include standard installation detail drawings where applicable.

1.2.5 SD-11, Closeout Submittals

a. Information card

b. Instructions to Government personnel

For each roofing installation, submit a typewritten card or photoengraved aluminum card containing the information listed on Form 1 located at the end of this section.

Submit instructions meeting the requirements of paragraph entitled "Instructions to Government Personnel" and include copies of Material Safety Data Sheets for maintenance/repair materials.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Manufacturer

TPO sheet roofing system manufacturer shall have at least 7 years experience in manufacturing TPO roofing products.

1.3.2 Qualification of Applicator

Roofing system applicator shall be approved, authorized, or licensed in writing by the TPO sheet roofing system manufacturer and shall have a minimum of three years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. Applicator shall have applied 5 installations of similar size and scope as this project, within the previous year.

1.3.3 Fire Safety

Complete roof covering assembly shall:

a. Have ASTM E 108 Class lA or UL 790 Class A classification; and

b. Be listed as part of Fire-Classified roof deck construction in the UL RMSD or Class I roof deck construction in the FM P7825.

UL approved components of the roof covering assembly shall bear the UL label.

1.3.4 Wind Uplift

Be aware that FM or UL designation of 90 does not necessarily mean roofing system can withstand winds of 144 kilometers 90 miles per hour. Each installation requires calculation of wind uplift pressures.

a. ASCE 7-95,"Minimum Design Loads for Buildings and Other Structures."

b. Factory Mutual Loss Prevention Data Sheet 1-7, "Wind Forces on Buildings and Other Structures," 1-28, "Insulated Steel Deck," and 1-28S, "Wind Uplift Pressures on Roofs."

c. ANSI/SPRI's "Wind Design Guide for Adhered Single-Ply Roofing Systems" and "Wind Design Guide for Mechanically Fastened Single-Ply Roofing Systems."

d. Complete roof covering assembly shall be rated Class I- 90 in accordance with FM P7825 capable of withstanding an uplift pressure of 90 pounds per square foot. In lieu of FM 1-90, the use of the UL test for uplift, with a minimum rating of 150 psf is allowed.

1.3.5 Preroofing Conference

After approval of submittals and before performing roofing and insulation work, including associated work, the Contracting Officer will hold a preroofing conference to review the following:

a. Drawings and specifications;

b. Procedure for onsite inspection and acceptance of roofing substrate and pertinent structural details relating to the roofing system;

c. Contractor's plan for coordination of work of the various trades involved in providing the roofing system and other components secured to the roofing; and

d. Safety requirements.

Preroofing conference shall be attended by the Contractor and personnel directly responsible for installation of roofing and insulation, flashing and sheet metal work, and a representative of the roofing materials manufacturer. Before beginning roofing work, confirm in writing the resolution of conflicts among those attending the preroofing conference.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in their original, unopened containers or wrappings with labels intact and legible. Where materials are covered by a referenced specification number, the labels shall bear the specification number, type, class, and shelf life expiration date where applicable. Deliver materials in sufficient quantity to allow continuity of work.

1.4.2 Storage

Store and protect materials from damage and weather in accordance with manufacturer's instructions, except as specified otherwise. Keep materials clean and dry. Mark and remove damaged materials from the site. Use pallets to support and canvas tarpaulins to completely cover stored material. Do not use polyethylene as a covering. Locate materials temporarily stored on the roof in approved areas, and distribute the load to stay within the live load limits of the roof construction. Remove unused materials from the roof at the end of each days work.

1.4.3 Handling

when hazardous materials are involved, adhere to the special precautions of the manufacturer. Adhesives may contain petroleum distillates and may be extremely flammable; prevent personnel from breathing vapors, and do not use near sparks or open flame. Do not use materials contaminated by exposure to moisture. Remove contaminated materials from the site.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not install TPO sheet roofing during high winds or inclement weather, or when there is ice, frost, moisture, or visible dampness on the substrate surface. Unless recommended otherwise by the TPO sheet manufacturer, do not install TPO sheet when air temperature is below 4 degrees C 40 degrees F or within 3 degrees C 5 degrees F of the dewpoint. Provide manufacturer's printed recommendations for installation during cold weather conditions.

1.6 WARRANTY

Furnish the roofing manufacturer's "no-dollar-limit" systems warranty for the roofing system, including insulation, flashing, and accessories. The warranty shall run directly to the Government. In no event shall the warranty period be less than 15 years from the date of the Government's acceptance of the work, notwithstanding roofing applicator's or manufacturer's unpaid invoices for installation, supplies, or service. The warranty shall include;

a. When within the warranty period the TPO sheet roofing system becomes nonwatertight, splits, tears, blisters or separates at the seams or shows any other evidence of excessive weathering because of defective materials or workmanship, the repair or replacement of defective materials and correction of defective workmanship shall be the responsibility of the roofing manufacturer;

b. When the manufacturer or the manufacturer's approved applicator fail to perform repairs within 72 hours of notification, emergency repairs performed by others will not void the warranty; and

c. Damage to the TPO roofing system caused by sustained winds having a velocity of 70 miles per hour or less is covered by the warranty.

1.7 DESIGN REQUIREMENTS

The entire roofing and flashing system shall be designed by the roofing membrane manufacturer to meet the requirements of this section under the conditions encountered at the site of the work and for the specific building's configuration.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 TPO Sheet

Thermoplasic Olefin(TPO), reinforced 0.060 inch minimum thickness for fully adhered application. Width and length of sheet shall be as recommended by the manufacturer.

2.1.2 Adhesive

As supplied and warranted by TPO sheet manufacturer and recommended by TPO manufacturer's printed data.

2.1.3 Lap Cleaner, Sealant, and Edge Treatment

As supplied by TPO sheet manufacturer and recommended by TPO sheet manufacturer's printed data.

2.1.4 Water Cutoff Mastic/Water Block

As supplied by TPO sheet manufacturer and recommended by TPO sheet manufacturer's printed data.

2.1.5 Flashing and Flashing Accessories

Flashing, including perimeter flashing, flashing around roof penetrations, and prefabricated pipe seals, shall be .055 inch minimum thick cured TPO, as recommended by the TPO sheet manufacturer's printed data.

2.1.6 Fasteners

As supplied and warranted for the substrate type(s) by TPO sheet manufacturer and recommended by TPO sheet manufacturer's printed data.

2.1.7 Rubber Walk Pads

Preformed rubber walk pads, compatible with the TPO sheet, .12 inches (120 mils) minimum thickness. Heat weldable to membrane surface. Walk pads shall come in 36” overall width, of which 29” is walk pad and 3 ½” to each side for heat welding to membrane surface. Install as indicated on plans and around equipment and roof access/traffic points.

2.1.8 Roof Insulation Below TPO Sheet

Insulation shall be compatible with TPO sheet as recommended in TPO manufacturer's printed instructions and as specified in Section 07220, "Roof and Deck Insulation". Facers of the insulation shall be a type permitting both fully adhered and mechanically fastened methods of membrane attachment.

PART 3 - EXECUTION

3.1 PREPARATION

Coordinate work with that of other trades to ensure that components which are to be incorporated into the roofing system including sheet metal components, are available to prevent delays or interruptions and are installed as the work progresses. Examine substrates to which the roofing materials are to be applied to ensure that their condition is satisfactory for its application. Do not permit voids greater than 6 mm 1/4 inch wide in the substrate. Concrete substrates shall be cured and free of laitance and curing compounds. Install wood blocking at perimeters, curbs, and penetrations. Substrates for roofing materials shall be dry and free of oil, dirt, grease, sharp edges, and debris. Inspect substrates, and correct defects before application of elastomeric sheets.

3.2 APPLICATION

Apply entire TPO sheet utilizing fully adhered application methods. Apply TPO sheet roofing in accordance with the TPO sheet manufacturer's application instructions and other requirements of this specification. As a substitute application method, the use of a vented roof system is permitted by the contractor, if approved by the membrane manufacturer.

3.2.1 Special Precautions

a. Do not dilute coatings or sealants unless specifically recommended by the materials manufacturer's printed application instructions. Do not thin liquid materials with cleaners used for cleaning TPO sheet.

b. Keep liquids in airtight containers, and keep containers closed except when removing materials.

c. Use liquid components, including adhesives, within their shelf life period. Store adhesives at 60 to 80 degrees F prior to use. Avoid excessive adhesive application and adhesive spills, as they can be destructive to some elastomeric sheets and insulations; follow adhesive manufacturer's printed application instructions. Mix and use liquid components in accordance with label directions and manufacturer's printed instructions.

d. Require workmen and others who walk on the membrane to wear clean, soft-soled shoes to avoid damage to roofing materials.

e. Do not use equipment with sharp edges which could puncture the TPO sheet.

3.2.2 Work Sequence

Arrange work to prevent use of newly constructed roofing for storage, walking surface, or equipment movement. Where access is necessary, provide temporary walkways, platforms, or runways to protect new roofing surfaces and flashings from mechanical damage.

3.2.3 TPO Sheet Roofing

Installed sheet shall be watertight and free of contaminants and defects that might affect serviceability. Edges of sheet shall be uniform, straight, and flat. Unroll TPO sheet roofing in position without stretching membrane. Inspect for holes. Remove sections of TPO sheet roofing that are damaged. Allow sheets to

relax at least 30 minutes before seaming. Lap sheets a minimum of 1.5 inches and as recommended by the TPO sheet roofing manufacturer.

3.2.3.1 Fully Adhered Application

Apply adhesive evenly and continuously to substrate and underside of sheets at rates recommended by TPO sheet manufacturer's printed application instructions. Allow adhesive to dry to consistency prescribed by manufacturer before adhering sheets to the substrate. Roll each sheet into adhesive to avoid wrinkles; broom or roll to remove air pockets and "fishmouths" and to ensure full, continuous bonding of sheet to substrate. Clean both mating surfaces at splice area, apply adhesive, lap adjoining sheets, and seal seams according to instructions of TPO sheet manufacturer. The use of one sided adhesives are strictly prohibited.

3.2.3.2 Vented Roof System Application

Lap adjoining sheets according to instructions of TPO sheet manufacturer. Clean the membrane using a recommended cleaner and lint-free applicator. Seal seams in accordance with TPO sheet manufacturer's printed instructions. Check seams to ensure continuous seal before proceeding with further work. Lay out membrane and seal to deck according to manufacturers instructions.

3.2.3.3 Perimeter Fastening

Mechanically secure TPO sheet at roof perimeter and penetrations with specified fasteners. Space fasteners a maximum of 6 inches o.c., except as recommended otherwise by TPO sheet manufacturer's printed data.

3.2.3.4 Temporary Work

Install temporary cutoffs and watertight seals around incomplete edges of roofing assembly at the end of each day's work and when work must be postponed due to inclement weather. Straighten insulation line using pieces of insulation loosely laid, and seal TPO sheet to deck

3.2.4 Flashing

Install flashing and flashing accessories as roofing sheets are installed in accordance with printed instructions and details of TPO sheet manufacturer. Extend base flashing not less than 8 inches above roofing surface. Completely adhere flashing sheets in place. Provide prefabricated pipe seals at pipe penetrations where possible, otherwise field-fabricate seals to conform to requirements specified in paragraph entitled "Flashing and Flashing Accessories".

3.2.5 Roof Walkways

Install rubber walk pads, using hot air welding for attachment, where indicated, and for traffic areas, and for access to mechanical equipment, in accordance with TPO sheet manufacturer's printed instructions.

3.3 FIELD QUALITY CONTROL

3.3.1 Instructions to Government Personnel

Furnish written and verbal instructions to designated Government personnel. Instructions shall be given by a competent representative of the TPO manufacturer and shall include a minimum of 4 hours on maintenance and emergency repair of membrane. Include demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and repair operations.

END OF SECTION